with an inoperable lesion a considerable amount of relief.

Colostomy, plus posterior resection, should be the operation of choice for patients whose general condition is such that they could not be expected to withstand a combined abdominoperineal resection. also a satisfactory operation for very low growths.

From the standpoint of total eradication of the disease the combined abdominoperineal resection in one stage is probably the operation of choice. It is a surgical procedure of first magnitude and should be undertaken only with patients in excellent general condition.

A combined abdominoperineal resection in two stages is the best alternative and is the operation of choice in the vast majority of cases. It has many variations. The early high mortality attributed to it was due to the infection occurring beneath the newly constructed pelvic floor resulting from the deprivation of blood supply to the portion of the colon to be removed. The type of drainage suggested by Doctor Smith, and subsequently advocated by Miles, answers most of the criticisms of the two-stage procedure. I have had an opportunity to follow several cases in which this type of drainage has been used and agree with Doctor Smith that it adequately takes care of the element of infection. I believe that it will do more to maintain the mortality of this operation at a low level than any other single factor in technique.

CLARENCE G. TOLAND, M. D. (902 Wilshire Medical Building, Los Angeles).—The satisfactory surgical management of tumors of the left colon, particularly of the rectosigmoid and rectal area, has been and is a problem that has intrigued the interest of our best surgical minds. Not so many years ago the individual who was unfortunate enough to be afflicted with a malignant rectal growth was given little encouragement, and his prospects for the future were very dark indeed. Palliative procedures, such as a simple colostomy, were offered, and only occasionally was an attempt made completely to eradicate the neoplastic process by a posterior resection.

The colostomies were frequently so poorly placed and constructed that their care was a heavy burden to the patient, and more likely than not he shunned his friends and was ostracized from society.

The posterior resection was a formidable procedure, entailing a heavy mortality, and many cases suffered from the disability incident to excision of the coccyx and part of the sacrum. The percentage of early recurrence was high and on the whole the results were most discouraging.

With the advent of the combined abdominal and perineal resection the situation improved and as the technical difficulties have gradually been overcome we have been able to offer our patients a reasonable chance for a cure. The postoperative disability has been materially lessened, allowing the individual the pleasures of society and the normal pursuit of his occupation.

A number of operative procedures have been devised in accomplishing the abdominoperineal resection, and they all have merit, particularly when applied to selected cases. Perhaps in no other condition is the axiom "Fit the operation to the patient, and not the patient to the operation," so true as in cancer of the rectum. Dr. Dudley Smith has been a substantial contributor in this field, and I, personally, prefer the type of operation he advocates. The little clamps he has devised have greatly facilitated the resection and have enabled us to frequently perform the operation in one stage. The use of the cautery in the perineal stage of the excision has proved to be most satisfactory. When we think of patients with five-year cures who are able satisfactorily to follow exacting occupations such as teaching school or the ministry, we cannot but realize that definite progress has been made, and the men who have made this possible are to be congratulated.

CRANIOCEREBRAL INTURIES*

A STUDY OF TWELVE HUNDRED CASES

By Delbert H. Werden, M. D. Los Angeles

DISCUSSION by Howard W. Fleming, M.D., San Francisco; Cyril B. Courville, M.D., Los Angeles.

URING the past decade frequent reports of large series of head injuries, both with and without skull fracture, have appeared in the literature. These have been prompted by the rapidly increasing number of craniocerebral injuries incident to modern life. The compilation of such reports is tedious and exacting, but in clinical experience and judgment statistics of this sort can be of considerable value.

CLINICAL MATERIAL FOR THIS STUDY

The material here presented consists of 1200 consecutive cases of head injury admitted to the neurosurgical service of the Los Angeles County General Hospital from July, 1929, to January, 1931, a period of approximately eighteen months. Rand and Nielsen 1 (1925) reported a series of 171 cases of proved skull fracture taken from 580 consecutive cases covering a period of approximately forty-one months from the same service of this hospital. The comparison of 580 cases occurring in forty months to 1200 cases in eighteen months shows the great increase in number of head injuries, as they are now five times as common as was the case six years ago, if one can judge by comparing two series of patients admitted to the same hospital.

The patients in this series were admitted to the service upon the basis, either of a history of head injury with loss of consciousness, even if that was momentary, or because examination by the admitting physician revealed evidences of a recent cranial injury. Patients are not included who left the hospital within a few hours without having had an x-ray examination of the skull, the period of observation being of too short a duration for inclusion in this series. The only fatal cases which were not included were those who died before an adequate physical examination could be done. Ninety-seven and a half per cent of the patients in this series received x-ray study, the only exceptions being patients whose condition was too critical to permit of this procedure. Few, if any, other series of head injuries which were reviewed received as high a percentage of x-ray study. Postmortem examinations were done in practically all fatal cases, as they came under the coroner's jurisdiction. Doctors Wagner and Schaefer carried out these examinations and permitted detailed microscopic studies in many of the cases. It should be added that one of the neurosurgical staff was present at about one-third of the postmortem examinations. Only four cases of the series were not autopsied; three were cases of obvious cerebral hemorrhage, and the fourth a severely depressed skull fracture.

^{*}From the Neurosurgical Service of Dr. Carl W. Rand, Los Angeles County General Hospital. *Read before the Neuropsychiatry Section of the Cali-fornia Medical Association at the sixtieth annual session, San Francisco, April 27-30, 1931.

	1	2	3	4	5	6	7
	Total	Per cent	Auto Accident	Hit by Auto	Assault Blows	Falls	Others
Total No. all cases	1200	100%	424	438	97	160	171
Recovered Fatal	1100 100	92% 8%	94%	92% 8%	95% 5%	88% 12%	91%
Number of fracture cases	371	100	125	107	28	57	54
Vault	103	28%	25%	35%	36%	21%	22%
Base	149	40%	45%	37%	39%	35%	40%
Vault and base	119	32%	30%	28%	25%	44%	37%

ETIOLOGY

The causes of head injury were found to fall principally into three groups, namely, one, automobile injuries; two, falls; and three, assaults.

Thirty per cent of the patients (125) who sustained fractures of the skull were injured while riding in automobiles. In about half of these 125 cases the fracture was in the base of the skull (Table 1, column 3). Bacon and LeCount 2 found that 34 per cent of the fractures in their series were in the vault, while 19 per cent were in the posterior fossa. This corresponds closely to the number of fractures (55 per cent) in my series which involved both of these areas. That the base is so frequently fractured may be due to the fact that in automobile accidents the impact to the vault is diffuse and the force is transmitted in greatest intensity to the weakened floors of the skull. Only 6.1 per cent of the people injured by automobile accidents died. Pedestrians (Table 1, column 4) comprise the largest single group of those suffering craniocerebral injuries. The incidence of fractures, however, is lower (25 per cent) in these injured pedestrians, who comprise 107 cases. This may be due to the fact that, when struck by an automobile, the patient in falling tends to protect his head. While skull fractures are fewer in pedestrians struck by automobiles, the mortality is slightly higher (8 per cent), showing that factors other than the head injury alone tend to cause death.

The automobile, in some manner, was directly responsible for the injury in 72 per cent of all the cases in the series here presented. A review of four series of head injuries by other writers over the period from 1918 to 1928 (Table 2) shows the relative increase of the automobile as

an etiological factor in causing injuries. My figures are much higher than those given by Vance ³ (37 per cent) and McCreery and Berry ⁴ (21 per cent). However, it must be borne in mind that all of Vance's cases were fatal, and, furthermore, that the period described by him covered the years from 1920 to 1926, while those described by McCreery and Berry covered from 1920 to 1928. My findings of increased percentage of those injured by automobiles may, in part, be due to lack of traffic regulation and, in part, to the greater use of motor vehicles.

Falls (Table 1, column 6) come next to automobiles as a cause of craniocerebral injury. The two together comprise 85 per cent of all causes. Falls of some description carry the highest mortality (12 per cent) and the greatest incidence of skull fracture (36 per cent). This may be due to the fact that the falling patient is unable to protect his head, and that the head nearly always strikes the ground or some other object. Of the fractures caused by falls, most involved the base (38 per cent) or the base and vault (44 per cent), while in a smaller number the fractures were confined to the vault alone. These figures suggest that in this type of injury the impact is unusually severe and that the resultant cranial damage is more extensive.

Assaults (Table 1, column 5) are the third most frequent cause of craniocerebral injuries, and are the least fatal (5 per cent). In these cases 36 per cent show fractures of the vault, while 39 per cent show fractures confined to the base. It was a surprise to find that a greater number of persons assaulted had basal fractures than had fractures confined to the vault, as one usually associates vault fractures with blows directed to the calvarium.

7	TABLE 2.—Etio	logy—In Repo	rts of Previous	Years	
Cause of Injury	1918 LeCount and Apfelbach	1925 Rand and Nielsen	1926 Vance	1928 McCreery and Berry	1931 Werden
Automobile	48	83	189	110	862
Falls	219	25	156	179	160
Assaults, Blows	51	14	33	62	. 97

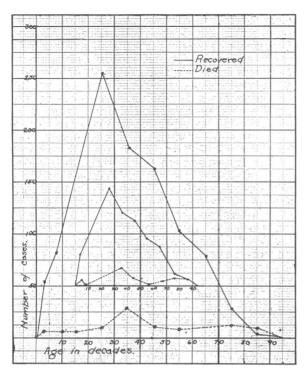


Fig. 1.—Age incidence in recovered and fatal cases.
(a) Larger figure for total series. (b) Smaller figure for patients with skull fracture.

AGE

The age curves in Figure 1 show that the largest number of all patients were in their third decade of life. The graph shows a rapid rise during the early decades and a somewhat more gradual fall during later life. Coincidentally, while the greatest number of injuries falls in the third decade, the highest mortality occurs in the fourth decade. Otherwise the percentage of deaths is fairly evenly distributed among the remaining decades. The larger graph, representing the whole series (1200), is practically identical to the smaller graph, representing the smaller series of patients who sustained fractures of the skull (371). The peak of the curve in each series is found in the third decade. Likewise, the curves for the fatal cases were similar.

In Figure 2 are shown graphs representing those patients who sustained fractures of the skull. The age of the patient is compared to the type of injury. I find that, in the third decade of life, automobile accidents are the principal cause of injury. On the other hand, patients between the ages of forty and seventy years who receive fractures are more frequently injured by

automobiles while walking. During the first decade of life falls and automobiles striking pedestrians cause most of the injuries.

FRACTURES OF THE SKULL

The presence of fractures of the skull was determined by one or more of three methods, namely, physical examination, x-ray study, or by postmortem findings. They were classified according to location either as being in the vault, the base, or both. Those of the vault alone were shown by x-ray examination or by autopsy. Those of the base were diagnosed clinically by the presence of a bleeding ear or by ecchymosis of an eye, or were revealed at autopsy. Those involving both the vault and base required all methods of diagnosis. Fractures of the vault were classified according to their location in respect to the frontal, parietal, temporal or occipital areas, while in basal fractures the particular cranial fossa involved was mentioned. Fractures of the occipital bone were classified with those of the vault. This was done because no marked anatomical difference separates that part of the bone which forms the floor of the posterior fossa from that which extends into the vault. Furthermore, fractures of the occipital bone are clearly shown

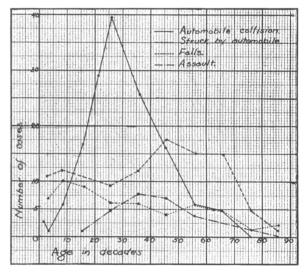


Fig. 2.—Cases of skull fracture, showing the causes of injury in each decade of life.

on the x-ray film, just as are fractures of the vault proper. On the contrary, fractures elsewhere in the base, *i. e.*, in the middle or anterior fossae, are very seldom demonstrated by the x-ray. Of the entire series, 371 patients (31 per

	Table 3	3.—Etiology of	all Fractures		
	1	2	3	4	5
Location of Fracture	Total Number	Auto Acc.	Hit by Auto	Assault, Blow	Falls
(a) Vault	103	31%	36%	10%	12%
(b) Base	149	38%	27%	7%	13%
(c) Vault and base	119	31%	25%	6%	21%

I	Table 4.—Fractures of	actures of the	the Vault—In Relation to Number, Sex, Etiology, and Site of Fracture	Relation to	Number, Sc	x, Etiology.	, and Site	of Fractur	9		
		2	3 4	ro	9	7	&	6	10	11	12
	Incid	Incidence	Sex		How 1	How Injured			Site of]	Site of Fracture	
Cases	No. of Fractures	Per Cent of All Cases	M F	Auto Acc.	Hit by Auto	Assault Blow	Falls	Front.	Par.	Temp.	Occ.
(a) Total (b) Recovered (c) Fatal	222 182 40	18.5% 82% 18%	80% 20% 81% 19% 77% 23%	31% 31% 30%	30% 30% 33%	8% 7% 10%	17% 16% 20%	25% 28% 10%	52% 55% 37%	31% 29% 42%	$\begin{array}{c} 20\% \\ 19\% \\ 22\% \end{array}$
(d) Fracture of vault and base recture of vault alone vault alone	119	54%	83% 17% 78% 22%	31%	26% 35%	6%	21%	25% 25%	59 <i>%</i> 45 <i>%</i>	41%	16% 24%

cent) were diagnosed as having a fracture of the skull. Of this number, 40, or 14.5 per cent, were fatal.

FRACTURES OF THE VAULT

Fractures of the vault alone (Table 3. line a) were more often caused by pedestrians being struck by automobiles. The majority of these fractures were diagnosed by x-ray examination, although a few which were compounded were diagnosed clinically. Fractures of this type will be found under Table 4. This group comprises 222 cases in all, of which 103 were fractures of the vault alone, and 119 were fractures involving both vault and base. The mortality of this series was 18.5 per cent, three times greater than the six per cent mortality found in patients without fractures. When the vault alone was involved by fractures, 45 per cent were parietal, and 21 per cent temporal. It was found, however, that when the impact was sufficient to fracture both vault and base, the fracture in the calvarium was extensive, and extended into more than one area in the vault, as shown in involvement in these cases of the parietal area in 59 per cent and the temporal area in 41 per cent. Fractures of the frontal bone occurred a little more frequently than those of the occipital bone.

FRACTURES OF THE BASE

It is exceedingly seldom that fractures of the base can be demonstrated by x-ray examination, consequently one depends upon external signs to establish this diagnosis. It is the consensus of opinion that one or more bleeding ears indicate a basal fracture in the middle fossa. In the absence of direct injury to the eyelids or to the rim of the orbit, ecchymosis of the lids of one eye is fairly definite evidence of fracture in the corresponding basal fossa. Furthermore, ecchymosis of the eyelids of both eyes is conclusive evidence of fracture across the floors of the anterior fossae. Vance 3 had shown that the roof of the orbit and the tegmen tympani are the weakest points in the base of the skull. These areas form the so-called webbs between radiating bony ridges and are, therefore, vulnerable to injury. Fractures of the base are summarized in Table 5. They constitute 22 per cent of all cases in this series and comprise a total of 268 cases. Of these, about half (55 per cent) were of the base

Total Tota		TABLE 5.—Fr	-Fractures of t	he Base–	-In Rel	ation to Numb	ractures of the Base—In Relation to Number, Sex, and Etiology	tiology		
No. of Fractures Per Cent of Fractures M F Auto Acc. Hit by Assault Auto Auto Auto Auto Auto Auto Auto Aut		F	2	8	4	5	9	L	20	6
No. of Fractures Per Cent of All Cases M F Auto Acc. Hit by Auto Blow Blow Blow Blow Blow Blow Blow Blo		Incid	ence	Sex				How Injured		
268 22% 78% 22% 34% 26% 6% 16% 228 85% 78% 22% 33% 25% 7% 16% 40 15% 76% 32% 30% 25% 5% 25% 119 45% 83% 17% 31% 26% 6% 21% 149 55% 73% 27% 37% 27% 14% 8% 14%	Cases	No. of Fractures	Per Cent of All Cases	M	দ	Auto Acc.	Hit by Auto	Assault Blow	Falls	Others
119 45% 83% 17% 31% 26% 6% 21% 149 55% 73% 27% 87% 87% 14%	(a) Total (b) Recovered (c) Fatal	268 228 40	22% 85% 15%		22% 22% 32%	34% 33% 30%	26% 28% 25%	6% 7% 5%	16% 16% 25%	18% 15% 15%
	(d) Fracture of base and vault	119	45% 55%		27%	31% 37%	26% 27%	6% 8%	21%	16%

	1	2	3	4	5	6
		hymo Eye			eedin m Es	
Patients	Right	Left	Both	Right	Left	Both
(a) Recovered (b) Fatal	30 6	28 5	63 9	50 7	49 5	18 3
(c) Total	36	33	72	57	54	21
(d) Fracture of base only	18	18	50	32	29	10
(e) Fracture of base and vault	18	13	22	25	25	11
(f) Total	36	33	72	57	54	21

alone and showed no x-ray evidence of fracture extending into the vault. The mortality in this group of fracture cases was 15 per cent. In almost half (45 per cent) of the fractures of the base found at autopsy, there had been no external signs to indicate the presence of the fracture.

Table 6 shows the distribution of signs of basal skull fracture. Ecchymosis of both eyes together (column 3) is more frequent than ecchymosis of either eye alone (columns 1 and 2). On the contrary, cases having one bleeding ear (columns 4 and 5) are much more common than those having bleeding from both ears, and are also more common than those having involvement of one eye. This leads one to assume that fractures of the anterior fossa are more likely to involve both fossae, while fractures of the middle fossae tend to involve but one fossa alone.

The relation between the external signs of basal fracture and an associated fracture of the vault is pointed out in Table 7. In from 34 to 47 per cent of patients suffering from bleeding ears or ecchymotic eyes the x-ray examination disclosed a fracture in the adjacent vault. It is found that unilateral ecchymosis and unilateral bleeding from the ears are more often associated with fractures of the adjacent vault, while, on the other hand, fractures involving both right and left fossae are more often confined to the base of the skull.

Comparison of clinical and postmortem findings in basal fractures was made (Table 8). The coroner found basal fractures in forty patients. In these patients only 55 per cent had shown clinical evidence of basal fracture. However, in

a group of thirty-five fatal cases in which a diagnosis of basal fracture was made on the clinical evidence alone, the fracture was found at autopsy in twenty-nine, or 85 per cent of cases. This shows that, when present, the signs of bleeding ears and ecchymotic eyes lead to a correct diagnosis in a large per cent of cases. Of all patients in the entire series who recovered, 22 per cent were considered from a clinical standpoint to have basal fractures. Judging from the discrepancy between the coroner's findings of basal fracture in 40 per cent (of whom one-half showed no evidence of basal fracture) and the clinical estimation of fracture in only 22 per cent, one would suppose that in recovered cases the actual number of patients suffering from basal fracture would be much larger than the clinical findings indicate.

There were six additional patients, four of whom had blackened eyes and two bleeding ears. In these a presumptive diagnosis of basal skull fracture was made clinically, but at autopsy none was found. It is probable that the bleeding from

Table Rela	7.—Clinical tion to Nea Sho	Signs of I r-by Fract wn on X-1	ure of Vau	ture—In lt, as
	1	2	3	4
	Ecchy- mosis	Total	With F	racture
	of Eyes	Number	Number	Per Cent
Fronto- Temporo- Parietal	Right Left Both	36 32 72	17 11 20	47% 34% 28%
	Hemor- rhage	Total	With F	'racture
	from Ears	Number	Number	Per Cent
Temporo- Parieto- Occipital	Right Left Both	56 54 21	24 22 1	43 % 41 % 5 %

the ears was from the tympanic membrane or external auditory canal alone, and that the blackened eyes were due to direct violence, which left no sign of injury other than the ecchymosis. This emphasizes the fact that, even with obvious signs, one must use care in examination and judgment when evaluating these findings.

Spinal fluid examinations (Table 9) were carried out in relatively few cases in this series. The incidence of increased spinal fluid pressure was found practically the same in cases with and with-

Table 8.—Verific	cation of	Clinical I	Evidence	of Base	ıl Fractur	?	
	1	2	3	4	5	6	7
	Eccl	nymosis of I	Cyes	Blee	ding from	Ears	
	Right	Left	Both	Right	Left	Both	Total
I.—Fracture correctly diagnosed (a) Found and located(b) Found but not located	6	3 1	4 2	4 1	5 0	2 1	24 5
(c) Total	6	4	6	5	5	3	29
I.—Fracture incorrectly diagnosed (d) Diagnosed but not found	1 6	1 2	2 2	2 7	0	0 2	6 23
(f) Total	7	3	4	9	4	2	29

Table 9.—Spina and Case	el Fluid in C es With and			vered
	1	2	3	4
	Pressi	ıre	Appeara	nce
1.—Without Fracture	Increased	Normal	Bloody	Clear
(a) Recovered (b) Fatal	23 6	12 5	25 6	12 5
(c) Total	29 (63%)	17	31 (65%)	17
II.—With Fracture				
(d) Recovered (e) Fatal	23 15	15 8	30 20	7 · 1
(f) Total	38 (62%)	23	50 (85%)	8
1	Į.		I	

out fracture. However, the occurrence of bloody spinal fluid was considerably higher in cases with fracture. LeCount and Apfelbach ⁶ stated that bleeding into the subarachnoid or subpial space occurred in about 95 per cent of all patients with skull fracture. As would be expected, both increase of pressure and occurrence of blood in the spinal fluid is found more often in the fatal than in the nonfatal cases.

MORTALITY FIGURES

One hundred of a total of 1200 patients died, giving a mortality of 8.3 per cent. Twenty-six per cent of these were women. Slightly over half (54 per cent) of the fatal cases had fractures of the skull. The average number of days in the hospital before death was 4.1 days, as is shown in Figure 3. Two patients died of internal hydrocephalus at sixty-five and seventy-two days, respectively, after receiving their injuries. Each of these patients had an occlusion of the aqueduct of Sylvius caused by fibrous tissue. It is assumed

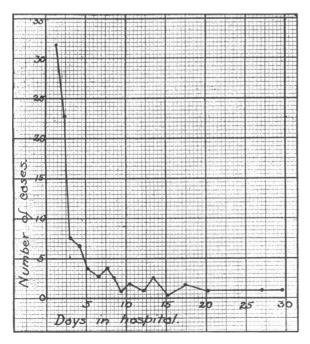


Fig. 3.—Fatal cases, showing the number of days in hospital before death. $% \frac{1}{2} \left(\frac{1}{2} - \frac{1}{2} \right) = \frac{1}{2} \left(\frac{1}{2} - \frac{1}{2} \right) \left(\frac{1}{2} - \frac{1}{2} - \frac{1}{2} \right) \left(\frac{1}{2} - \frac{1}{2} - \frac{1}{2} - \frac{1}{2} \right) \left(\frac{1}{2} - \frac{1}{2} -$

that in each patient the aqueduct had been filled by a blood clot which later became organized.

CAUSES OF DEATH

These are summarized in Table 10. Three-fourths of all patients who succumbed following injuries of the head died of the craniocerebral injury per se. Their average extent of life following injury was 3.3 days. The lesion causing death in 66 per cent of these cases was some type of intracranial hemorrhage. In addition, nine patients died of other intracranial complications, consisting of hydrocephalus, meningitis, fat embolism, and cerebral softening. The average dura-

Table 10.—Fatal Cases	-With Cause	s of Death
·	Number of Cases	Average No. of Days in Hospital
I. Craniocerebral Trauma A. Immediate Hemorrhage Extradural Subdural* Intracerebral Diffuse petechial Contusion and laceration Concussion B. Complications Cerebral softening Cerebral embolism Meningitis Hydrocephalus	7 24 12 4 14 5 9 1 4 3 3	3.3 1.7 3.4 4.1 3.7 3.8 1.6 27.0 11.0 8.5 55.7
	Total 75	Av. 6.0 days
II. Other Causes Ruptured viscus and hemorrhage Pneumonia Pulmonary embolism Shock Cervical cord injury Senility (79 and 81 years) Perforated gastric ulcer Fractured extremities	7 6 3 3 2 2 2 1 1	1.8 2.5 17.0 3.0 9.5 15.0 8.0 2.0
* These cases include bo	Total 25	Av. 5.9 days

*These cases include both localized and diffuse subdural hemorrhage, and diffuse subarachnoid hemorrhage.

tion of life for these patients with complications was 26.6 days. Twenty-five patients died from causes other than craniocerebral trauma. The most frequent of these were pneumonia, punctured lung, and hemorrhage from ruptured abdominal viscera, while fracture of the long bones, cervical cord injury, and shock caused the death of the remaining patients.

SUMMARY AND CONCLUSIONS

- 1. Twelve hundred consecutive cases of craniocerebral trauma have been studied. The results of such a study should be of considerable value in establishing the incidence and locations of skull fractures, as well as the cause, the mortality and the fatal lesions in this type of injury.
- 2. The automobile causes by far the greatest number of injuries (72 per cent).
- 3. Fractures of the skull were diagnosed in 31 per cent of the patients. Fractures of the vault were proved by x-ray in 18.5 per cent. Fractures of the base were diagnosed clinically in 22 per cent of patients. About half of the basal fractures involved both the vault and the base.

- 4. In the absence of signs of direct trauma, ecchymosis of the eyelids and hemorrhage from the external auditory canal are reliable signs of basal skull fracture.
- 5. Basal fractures are much more common than is generally supposed, probably occurring in from 30 to 40 per cent of all patients suffering craniocerebral trauma.
- 6. The mortality varies from six per cent in patients without fracture to 14.5 per cent in patients with fracture. The greatest mortality (18 per cent) is found in the group of patients having fractures involving both vault and base.
- 7. Intracranial hemorrhage is the most common gross lesion found at autopsy.

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DISCUSSION

HOWARD W. FLEMING, M. D. (384 Post Street, San Francisco).—Doctor Werden's painstaking study of such an extensive number of consecutive head injuries is a valuable contribution. It is rather alarming to note the rapid increase in the number of injuries caused by automobiles. The figures given suggest that serious head injuries are five times as common now as they were six years ago. Previously, extensive experience with this type of injury was limited to those specializing in neurosurgery or to surgeons doing a great deal of industrial work. Such an alarming increase in the number of automobile accidents emphasizes the necessity for better preparedness to care for serious head injuries on the part of the medical profession as a whole. In a considerable number of cases the decision as to therapy is difficult. No doubt many ill-advised operations are done and probably, more frequently, symptoms and signs suggesting the necessity for surgical treatment are not recognized. There are a few well-recognized principles which should be given wide publicity in the medical literature. Every physician should be prepared to treat shock in an approved manner and to interpret observations that suggest serious intracranial complication.

I was much impressed by the low mortality rate and especially by the low incidence of meningitis in this series of cases reviewed by Doctor Werden. The figures given must be interpreted as the results to be expected in a series of head-injury cases cared for under the most advantageous circumstances. Only a small percentage of such patients are treated by a trained and experienced personnel, working in hospitals which have all the necessary equipment.

It would be most interesting and instructive if Doctor Werden would supplement this report with an article detailing the methods of examination and treatment used by the neurosurgical service of the Los Angeles County General Hospital.

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Cyril B. Courville, M. D. (1100 North Mission Road, Los Angeles).—A statistical study, such as here presented, furnishes material of great interest and value on the subject of brain injury. Such investigations as a whole, however, are often difficult to properly evaluate owing to the wide variation in limiting circumstances characteristic of the local situation. This study presents as near as possible a true insight into existing conditions as can be obtained from hospital records, particularly since the data comes from as large an institution as the Los Angeles County General Hospital. Doctor Werden has brought out the essential facts to be gained from such a study and these need not be elaborated upon further. All that can be added by way of discussion, perhaps, is a clarification of some of the existing circumstances, so that the figures presented may be of greater value to those statistically minded.

In Los Angeles, individuals sustaining head injuries from whatever cause (excepting industrial accident cases) are as a rule first taken to one of the receiving hospitals of the city, or one of the county health centers. If the patient survives for more than a few hours, he is transferred to a private hospital or to the Los Angeles County General Hospital, depending on his financial circumstances. The cases which Doctor Werden includes in his series represent, therefore, the individuals of this group who have been brought to the Los Angeles County General Hospital.

Of a series of eighty fatal cases coming to the coroner's autopsy, which have been made a subject of special pathological study, 8, or 10 per cent, were killed outright; 19, or 23.75 per cent, died within three hours; 18, or 22.5 per cent, died between three and twenty-four hours; 25, or 31.25 per cent, survived one to seven days; and 10, or 12.5 per cent, died after the first week following injury. As near as can be estimated from my figures, individuals constituting the first two groups (about one-third of all fatal cases), do not survive long enough to be admitted to this or private hospitals. Most of the others, constituting about two-thirds of the whole, had been transferred elsewhere. The survival periods of this group of fatal cases correspond closely to those given by Doctor Werden (Fig. 3) and, therefore, form a fairly accurate basis for computation. If this is true, Doctor Werden's figure for total hospital mortality (81/3 per cent) represents perhaps two-thirds of the true mortality of all head injuries, making it about 12 per cent for Los Angeles County. The patients who succumb within a few hours would necessarily fall in the group of more severe head injuries with extensive basal fractures, laceration of the brain, and diffuse subarachnoid hemorrhage.

In order to get a true estimate of the existing circumstances in the given community, it would be necessary to make a rather extensive study of data secured from several sources, including the number of accidents as obtained from the police records, the number and fate of patients admitted to the emergency hospitals, a study of the coroner's statistics as well as information obtained from large, well-organized hospitals, such as has been presented here. Doctor Werden's figures are perhaps more significant to some of us who appreciate that most of these patients have been examined by him personally and remained under his observation during their stay in the hospital.

Doctor Werden (Closing).—I am indebted to Doctor Courville for his remarks which make more clear the fact that the figures in this paper are based solely upon the patients studied within the hospital. For statistics on head injuries throughout Los Angeles County, his comments are timely.

Doctor Fleming's discussion prompts me to add the following: The subject of craniocerebral trauma is itself so extensive that a lengthy monograph would be required to properly deal with all of its phases. In order to consider but a single aspect of the subject, I have limited myself in this paper to a more or less statistical study. We have had between five and six thousand cases of head injuries on the neurosurgical service of this hospital during the past twelve years. A system of treatment has been developed which we feel meets the conditions presented. It is hoped that this plan of therapy has been instrumental in lowering the mortality rate and the incidence of complications. The details of treatment as well as the pathology of head injury, the modus operandi of symptom production, the indications for operative intervention will probably be made the subjects of further reports from this service.

SIGMOID SINUS THROMBOSIS*

REPORT OF CASE

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A UNIQUE case of sepsis of otitic origin, occurring in our practice a short time ago, furnishes the basis for the following discussion under the general heading of sinus thrombosis. This is not to be an extensive dissertation on sinus thrombosis, but a consideration of some of the problems which presented themselves to us. It is hoped their discussion will prove instructive to the otolaryngologist as well as to the general practitioner.

REPORT OF CASE

History.—M. P., male, farmer, age eighteen, came into the office on July 21, 1931, complaining of right earache, general malaise, and fever. Aside from the usual childhood diseases and a tonsillectomy eight years ago, he had always been in good health, except that nine years previously his right ear commenced to discharge. This discharge later began to have a foul odor and continued intermittently until about four months ago, when it stopped completely. About two months later the ear began to pain him. The pain was deep-seated, as if it were located inside the head. This was soon followed by a recurrence of the discharge and relief of the pain. The ear then again stopped discharging, but caused him no particular pain until last night, when it became very severe.

Examination.—Examination revealed a thickening of the right tympanic membrane with a small perforation superiorly and anteriorly. There was a scanty, thin, watery secretion overlying the drum membrane. Patient's temperature was 103 degrees Fahrenheit, and his mental condition appeared sluggish. A diagnosis of an acute exacerbation of a chronic otitis media was made and the patient sent home for observation.

Course.—On the next morning we were called to see him because of increasing pain in the ear, vertigo, nausea, and vomiting. The temperature during the night had increased to 104 degrees Fahrenheit. Examination of the membrana tympani revealed no change. There was a first-degree nystagmus to the right. Hearing for the whispered voice was found to be ten inches for the S's and two feet for the 9's. The temperature was 99.4 degrees Fahrenheit.

The same morning (July 22) the patient was transferred to Saint Joseph's Hospital. On entrance he was nauseated, drowsy, and complained of slight headache. He vomited several times during the day, espe-

cially on exertion. That evening his temperature went up to 104 degrees Fahrenheit, and the next morning was down to normal. The nystagmus continued, there was a questionable Kernig and a questionable rigidity of the neck. Pressure along the anterior border of the right sternocleido mastoid muscle revealed tenderness. No tache cerebrale. No local mastoid signs.

At nine o'clock the next morning, patient had a severe chill which lasted fifteen minutes.

Because of evidence of meningeal irritation, a neurologist (Doctor Delehanty) was called in consultation that evening (July 23). Spinal fluid examination showed: Pressure not increased; colorless, clear; cell count 3; globulin negative; sugar 77.1 milligrams per 100 cubic centimeters; no organisms; Wassermann negative. Because of the above and negative neurological findings, he reported absence of meningitis.

To rule out some other condition that might be responsible for the septic manifestations, Dr. J. N. Hall, an internist, was asked to examine the patient. He reported the heart and lungs, appendix, gall-bladder, veins of extremities, all negative. The urine showed nothing serious enough to cause patient's symptoms. He thought the trouble was all related to the ear, or, as he expressed it, "above the neck."

The pain in the ear and the other symptoms continued. There was another chill the next morning (July 24), followed by a rise of temperature to 102 degrees Fahrenheit, which later declined to 97 degrees Fahrenheit.

Laboratory Examinations.—Laboratory examinations on date of admission (July 22) showed: Urinalysis negative except for a positive albumin and occasional epithelial, pus, and blood cell.

Blood examination: hemoglobin, 80 per cent; red cells, 4,520,000; white cells, 10,400; polynuclears, 88 per cent; lymphocytes, 9 per cent; large mononuclears, 3 per cent. Schilling count: Immature cells, 47; Schilling index, 0.9.

X-ray of mastoids (July 23, by Doctor Crosby): "There is some pathology in the left mastoid, although all of the cell structure is apparently intact. The right mastoid shows a broken outline of the anterior wall of the lateral sinus which apparently is due to necrosis. At this point there is increased density of the shadow of the lateral sinus which may indicate a thrombosis."

With the above clinical picture and laboratory reports a preoperative diagnosis of right sigmoid sinus thrombosis was made, and the patient was operated at noon on July 24.

Findings on Operation.—The mastoid was sclerotic and dense, and devoid of cellular structure except for slight pneumatization of the tip. There was much bony vascular engorgement and the bleeding was very profuse and difficult to control. The mastoid process was widely exenterated, with free exposure over entire mastoid area and large exposure of dura. No lateral sinus was found. The dura was incised in two places at supposed location of sinus, but no free bleeding occurred nor was any clot found, forcing us to presume the absence of a right sigmoid sinus.

Postoperatively the patient continued to run a septic temperature, reaching as high as 103.8 degrees Fahrenheit, then dropping to normal or below normal for a period of four days, and preceded by one or two chills daily. On July 28, fifth day postoperative, the temperature only went up to 100 degrees Fahrenheit. The next day (July 29) the temperature again rose to 104 degrees Fahrenheit, then dropped to normal; varied between 101 and 103 degrees Fahrenheit on the 30th; remained around 100 degrees Fahrenheit on the 31st, and thereafter continued normal, when the patient entered upon his convalescence and has remained well since then.

Culture from the mastoid taken at operation was reported, "contaminated with air organisms." Culture from material obtained from the right middle ear, after incision of right membrana tympani at time of operation, was reported negative. Blood culture taken postoperatively revealed no growth.

^{*} Read before the Eye, Ear, Nose, and Throat Section of the Utah State Medical Association, September 9-11, 1931.